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Publications of the Planetary Biology Program for 1977

A Special Bibliography

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Publications of the Planetary Biology Program for 1977

A Special Bibliography

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Office of Space Science
Washington, D.C.

National Aeronautics
and Space Administration

**Scientific and Technical
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INTRODUCTION

The Planetary Biology Program, within the Office of Space Science of the National Aeronautics and Space Administration, is the first and only integrated program to methodically investigate the planetary events which may have been responsible for, or related to, the origin, evolution, and distribution of life in the universe. Research supported by this program is divided into the seven areas listed below together with a statement of the principal objective of each research area.

Chemical Evolution - To understand how biologically significant organic molecules are synthesized under conditions presumed to have existed on the primitive Earth before the advent of life or which may presently exist on other planets.

Organic Geochemistry - To analyze terrestrial and extraterrestrial material for organic molecules, biological structures, and other clues to the origin(s) of life on this and other planets.

Life Detection - To develop and implement techniques to search for, detect, and characterize life and life-related molecules on this and other planets.

Biological Adaptation - To understand the adaptive mechanisms used by terrestrial organisms to survive and/or grow in environmental extremes approaching those on other planets.

Bioinstrumentation - To design, develop, and test prototype spaceflight instruments which will be used to detect and characterize life and life-related molecules on the surface and in the atmosphere of other planets.

Planetary Environments - To develop analytical techniques which measure environmental parameters on other planets which are relevant to the search for life.

Origin of Life - To identify the sequence of events leading from the putative complex organic milieu in the primordial terrestrial oceans to the origin of the first living systems.

The arrangement of references in this bibliography follows the division of research described. Articles are listed alphabetically by author under the research area with which they are most closely related. Only those publications which resulted from research supported by the Planetary Biology Program and which bear a 1977 publication date have been included. Abstracts, theses, and presentations are not included because of the preliminary and abbreviated nature of the former and the frequent difficulty of obtaining the latter.

Our intent in compiling this bibliography is twofold. First, we would like to provide the scientific community with an annual listing, beginning with 1975, of current publications resulting from research pursued under the auspices of NASA's Planetary Biology Program. Secondly, we hope to stimulate the exchange of information and ideas among scientists working in the different areas of the program. To facilitate the exchange process, we have identified, by asterisk, the author of each publication who is presently participating in the program. Current addresses for all principal investigators are given in the Appendix.

We wish to thank all the participants of the Planetary Biology Program for their cooperative response to our request for an enumeration of their 1977 publications.

Chemical Evolution

Atreya, S.K., T.M. Donahue, and W.R. Kuhn*. The distribution of ammonia and its photochemical products on Jupiter. Icarus 31(3): 348-355. July 1977.

Biemann*, K., J. Oro*, P. Toulmin, L.E. Orgel*, A.O. Nier, D.M. Anderson, P.G. Simmonds, D. Flory, A.V. Diaz, D.R. Rushneck, J.E. Biller, and A.L. Lafleur. The search for organic substances and inorganic volatile compounds in the surface of Mars. Journal of Geophysical Research 82(28): 4641-4658. September 30, 1977.

Binder, A.B., R.E. Arvidson, E.A. Guinness, K.L. Jones, E.C. Morris, T.A. Mutch, D.C. Pieri, and C. Sagan*. The geology of the Viking Lander 1 site. Journal of Geophysical Research 82(28): 4439-4451. September 30, 1977.

Bonner*, W.A., M.A. Van Dort, M.R. Yearian, H.D. Zeman, and G.C. Li. Polarized electrons and the origin of optical activity. Israel Journal of Chemistry 15: 89-95. 1976/1977.

Bragin, J., M. Diem, D. Guthals, and S. Chang*. The vibrational spectrum and lattice dynamics of polycrystalline ammonium hydrosulfide. Journal of Chemical Physics 67(3): 1247-1256. August 1, 1977.

Carhart, R.E., T.H. Varkony, and D.H. Smith[1]. Computer assistance for the structural chemist. In: Smith, D.H., ed. Computer-Assisted Structure Elucidation. Washington, D.C., American Chemical Society, 1977. (ACS Symposium Series 54) p. 126-145.

Chang*, S. and R.D. MacElroy. Possible nutrients and energy sources available to contaminating terrestrial organisms on Jupiter. In: Holmquist, R., ed. Life Sciences and Space Research, Volume XV. Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8-19, 1976. New York, Pergamon Press, 1977. p. 89-93.

Ehler, K.W., E. Girard, and L.E. Orgel*. Reactions of polyfunctional amino acids with *N,N'*-carbonyldiimidazole in aqueous solution -- oligopeptide formation. Biochimica et Biophysica Acta 491: 253-264. March 28, 1977.

Ehrlich[1], S.D. Replication and expression of plasmids from *Staphylococcus aureus* in *Bacillus subtilis*. Proceedings of the National Academy of Sciences of the U.S.A. 74(4): 1680-1682. April 1977.

---

[1]Lederberg, J., Principal Investigator

Eichberg, J., E. Sherwood, D.E. Epps, and J. Oro*. Cyanamide mediated syntheses under plausible primitive Earth conditions. IV. The synthesis of acyglycerols. Journal of Molecular Evolution 10(3): 221-230. 1977.

Elliot, J.L., R.G. French, E. Dunham, P.J. Gierasch, J. Veverka, C. Church, and C. Sagan*. Occultation of ε geminorum by Mars: Evidence for atmospheric tides? Science 195(4277): 485-486. February 4, 1977.

Elliot, J.L., R.G. French, E. Dunham, P.J. Gierasch, J. Veverka, C. Church, and C. Sagan*. Occultation of ε geminorum by Mars. II. The structure and extinction of the Martian upper atmosphere. Astrophysical Journal 217(2, Pt. 1): 661-679. October 15, 1977.

Ferris*, J.P., P.C. Joshi, and J.G. Lawless. Chemical evolution. XXIX. Pyrimidines from hydrogen cyanide. BioSystems 9(2,3): 81-86. September 1977.

Ferris*, J.P., C. Nakagawa, and C.T. Chen. Photochemical synthesis of organic compounds on Jupiter initiated by the photolysis of ammonia. In: Holmquist, R., ed. Life Sciences and Space Research, Volume XV. Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8-19, 1976. New York, Pergamon Press, 1977. p. 95-99.

Flores, J.J., W.A. Bonner*, and G.A. Massey. Asymmetric photolysis of (*RS*)-leucine with circularly polarized ultraviolet light. Journal of the American Chemical Society 99(11): 3622-3625. May 25, 1977.

Flores, J.J., W.A. Bonner*, and M.A. Van Dort. The gas chromatographic resolution of DL-isovaline. Journal of Chromatography 132(1): 152-154. February 1, 1977.

Folsome*, C. The permuted generator hypothesis for the origin of a genetic code. Origins of Life 8(4): 391-392. December 1977.

Folsome*, C. Reply [concerning the role of organic microstructures and the origin of cellular life]. Naturwissenschaften 64(7): 381. July 1977.

Frick, U. and S. Chang*. Ancient carbon and noble gas fractionation. In: Proceedings of the Eighth Lunar Science Conference, Volume 1, Houston, Texas, March 14-18, 1977. New York, Pergamon Press, 1977. p. 263-272.

Griffith, E.J., C. Ponnamperuma*, and N.W. Gabel. Phosphorus, a key to life on the primitive Earth. Origins of Life 8(2): 71-85. August 1977.

Hanel, R., B. Conrath, D. Gautier, P. Gierasch, S. Kumar, V. Kunde, P. Lowman, W. Maguire, J. Pearl, J. Pirraglia, C. Ponnamperuma*, and R. Samuelson. The Voyager infrared spectroscopy and radiometry investigation. Space Science Reviews 21(2): 129-157. November 1977.

Holzer, G. and J. Oro*. Pyrolysis of organic compounds in the presence of ammonia. The Viking Mars Lander site alteration experiment. Organic Geochemistry 1(1): 37-52. November 1977.

Isaacman, R. and C. Sagan*. Computer simulations of planetary accretion dynamics: Sensitivity to initial conditions. Icarus 31(4): 510-533. August 1977.

Kavasmaneck, P.R. and W.A. Bonner*. Adsorption of amino acid derivatives of *d*- and l-Quartz. Journal of the American Chemical Society 99(1): 44-50. January 5, 1977.

Khare, B.N. and C. Sagan*. On the temperature dependence of possible S_8 infrared bands in planetary atmospheres. Icarus 30(1): 231-233. January 1977.

Kuhn*, W.R., S.K. Atreya, and S. Chang. The distribution of methylamine in the Jovian atmosphere. Geophysical Research Letters 4(5): 203-206. May 1977.

Levine, J.S., D.R. Kraemer, and W.R. Kuhn*. Solar radiation incident on Mars and the outer planets: Latitudinal, seasonal, and atmospheric effects. Icarus 31(1): 136-145. May 1977.

Levinthal, E.C., K.L. Jones, P. Fox, and C. Sagan*. Lander imaging as a detector of life on Mars. Journal of Geophysical Research 82(28): 4468-4478. September 30, 1977.

Lohrmann, R[1]. Formation of nucleoside 5'-phosphoramidates under potentially prebiological conditions. Journal of Molecular Evolution 10(2): 137-154. 1977.

McLean, A.D., G.H. Loew*, and D.S. Berkowitz. Structures and spectra of the isomers HNCO, HOCN, HONC, and HCNO from ab initio quantum mechanical calculations. Journal of Molecular Spectroscopy 64(2): 184-198. February 1977.

Miquel, J., J. Oro*, K.G. Bensch, and J.E. Johnson, Jr. Lipofuscin: Fine structural and biochemical studies. In: Pryor, W.A., ed. Free Radicals in Biology, Volume III. New York, Academic Press, 1977. p. 133-182.

[1]Orgel, L.E., Principal Investigator

Mizutani, H. and C. Ponnamperuma*. The evolution of the protein synthesis system. I. A model of a primitive protein synthesis system. Origins of Life 8(3): 183-219. October 1977.

Nooner, D.W. and J. Oro*. Hydrocarbons and fatty acids in oil shale of Permian Irati Formation, Brazil. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 69-79.

Nooner, D.W., E. Sherwood, M.A. More, and J. Oro*. Cyanamide mediated syntheses under plausible primitive Earth conditions. III. Synthesis of peptides. Journal of Molecular Evolution 10(3): 211-220. 1977.

Noyes, H.P., W.A. Bonner*, and J.A. Tomlin. On the origin of biological chirality via natural beta-decay. Origins of Life 8(1): 21-23. April 1977.

Orgel*, L.E. β-turns and the evolution of protein synthesis. In: Bradbury, E.M. and K. Javaherian, eds. The Organization and Expression of the Eukaryotic Genome. (Proceedings of the International Symposium, Tehran, May 3-6, 1976) New York, Academic Press, 1977. p. 499-504.

Oro*, J. El Origen de la Vida. Boletin Informativo 65: 3-25. 1977.

Oro*, J. Quimica Prebiologica y el Origen de la Vida: Una Vision Personal. In: Cornudella, L., J. Oro, A. Sols, and C. Fernandez-Heredia, eds. Avances de la Bioquimica. Barcelona, Salvat, 1977. p. 515-541.

Oro*, J., S.L. Miller, and H.C. Urey. Energy conversion in the context of the origin of life. In: Buvet, R., M.J. Allen, and J.P. Massué, eds. Living Systems as Energy Converters. (Proceedings of the Conference, Pont-à-Mousson, France, October 18-22, 1976) Amsterdam, North-Holland, 1977. p. 7-19.

Owen, T., K. Biemann*, D.R. Rushneck, J.E. Biller, D.W. Howarth, and A.L. Lafleur. The composition of the atmosphere at the surface of Mars. Journal of Geophysical Research 82(28): 4635-4639. September 30, 1977.

Pollock*, G.E., C.-N. Cheng, and S.E. Cronin. Determination of the D and L isomers of some protein amino acids present in soils. Analytical Chemistry 49(1): 2-7. January 1977.

Pollock*, G.E., R. Day, S. Kinsey, and S.L. Miller. Detection of optical asymmetry in amino acids by gas chromatography for extra-terrestrial space exploration: Results of a new soil processing scheme with breadboard instrumentation. In: Holmquist, R., ed. Life Sciences and Space Research, Volume XV. Proceedings of the

Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8-19, 1976. New York, Pergamon Press, 1977. p. 27-34.

Ponnamperuma*, C., A. Shimoyama, M. Yamada, T. Hobo, and R. Pal. Possible surface reactions on Mars: Implications for Viking biology results. Science 197(4302): 455-457. July 29, 1977.

Sagan*, C. The Dragons of Eden: Speculations on the Evolution of Human Intelligence. New York, Random House, 1977. 263 p.

Sagan*, C. Exploration of the planets. An invited discourse presented before the Sixteenth General Assembly of the International Astronomical Union, Grenoble, France, August 1976. In: Müller, E.A., ed. Highlights of Astronomy, Volume 4 (Part 1). Dordrecht, Holland, D. Reidel, 1977. p. 37-67.

Sagan*, C. Reducing greenhouses and the temperature history of Earth and Mars. Nature 269(5625): 224-226. September 15, 1977.

Sagan*, C., D. Pieri, P. Fox, R.E. Arvidson, and E.A. Guinness. Particle motion on Mars inferred from the Viking Lander cameras. Journal of Geophysical Research 82(28): 4430-4438. September 30, 1977.

Sherwood, E., A. Joshi, and J. Oro*. Cyanamide mediated syntheses under plausible primitive Earth conditions. II. The polymerization of deoxythymidine 5'-triphosphate. Journal of Molecular Evolution 10(3): 193-209. 1977.

Sherwood, E. and J. Oro*. Cyanamide mediated syntheses under plausible primitive Earth conditions. I. The synthesis of P^1, P^2 dideoxythymidine 5'-pyrophosphate. Journal of Molecular Evolution 10(3): 183-192. 1977.

Smith, B.A., G.A. Briggs, G.E. Danielson, A.F. Cook, 2nd, M.E. Davies, G.E. Hunt, H. Masursky, L.A. Soderblom, T.C. Owen, C. Sagan*, and V.E. Suomi. Voyager imaging experiment. Space Science Reviews 21(2): 103-127. November 1977.

Smith, D.H., M. Achenbach, W.J. Yeager, P.J. Anderson, W.L. Fitch, and T.C. Rindfleisch[1]. Quantitative comparison of combined gas chromatographic/mass spectrometric profiles of complex mixtures. Analytical Chemistry 49(11): 1623-1632. September 1977.

Toon, O.B., J.B. Pollack, and C. Sagan*. Physical properties of the particles composing the Martian dust storm of 1971-1972. Icarus 30(4): 663-696. April 1977.

[1]Lederberg, J., Principal Investigator

Van Dort, M.A. and W.A. Bonner*. The quantitative gas chromatographic resolution of amino ester diastereomers. Journal of Chromatography 133(1): 210-213. March 11, 1977.

Organic Geochemistry

Aldridge, A.K., P.W. Brooks, G. Eglinton, and J.R. Maxwell[1]. The analysis of the hydrocarbons of petroleum. In: The Genesis of Petroleum and Microbiological Means for Its Recovery. (Proceedings of the Microbiology Group Symposium, London, October 6, 1976) London, Institute of Petroleum, 1977. p. 4-21.

Anderson, R., M. Kates, M.J. Baedecker, I.R. Kaplan*, and R.G. Ackman. The stereoisomeric composition of phytanyl chains in lipids of dead sea sediments. Geochimica et Cosmochimica Acta 41(9): 1381-1390. September 1977.

Awramik, S.M. and E.S. Barghoorn*. The Gunflint microbiota. Precambrian Research 5(2): 121-142. August 1977.

Baedecker, M.J., R. Ikan, R. Ishiwatari, and I.R. Kaplan*. Thermal alteration experiments on organic matter in recent marine sediments as a model for petroleum genesis. In: Yen, T.F., ed. Chemistry of Marine Sediments. Ann Arbor, Michigan, Ann Arbor Science Publishers, 1977. p. 55-72.

Barghoorn*, E.S. Eoastrion and the metallogenium problem. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 185-186.

Barghoorn*, E.S., A.H. Knoll, H. Dembicki, Jr., and W.G. Meinschein. Variation in stable carbon isotopes in organic matter from the Gunflint Iron Formation. Geochimica et Cosmochimica Acta 41(3): 425-430. March 1977.

Bloeser, B., J.W. Schopf*, R.J. Horodyski, and W.J. Breed. Chitinozoans from the late Precambrian Chuar Group of the Grand Canyon, Arizona. Science 195(4279): 676-679. February 18, 1977.

Brooks, P.W., J.N. Cardosa, B. Didyk, G. Eglinton, M.J. Humberston, and J.R. Maxwell[1]. Analysis of lipid fractions from environmental and geological sources by computerized GC-MS. In: Campos, R. and J. Goni, eds. Advances in Organic Geochemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 433-453.

Brooks, P.W., G. Eglinton, S.J. Gaskell, D.J. McHugh, J.R. Maxwell, and R.P. Philp[1]. Lipids of recent sediments. Part II. Branched and cyclic alkanes and alkanoic acids of some temperate lacustrine and sub-tropical lagoonal/tidal-flat sediments. Chemical Geology 20(3): 189-204. September 1977.

---

[1]Calvin, M., Principal Investigator

Brooks, P.W., J.R. Maxwell, J.W. Cornforth, A.G. Butlin, and C.B. Milne[1]. Stereochemical studies of acyclic isoprenoid compounds. VI. The stereochemistry of farnesane from crude oil. In: Campos, R. and J. Goni, eds. Advances in Organic Geochemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 81-97.

Burlingame[1], A.L. Assessment of the trace organic molecular composition of industrial and municipal wastewater effluents by capillary gas chromatography/real-time high resolution mass spectrometry: A preliminary report. Ecotoxicology and Environmental Safety 1: 111-150. 1977.

Cardosa, J.N., G. Eglinton, and P. Holloway[1]. The use of cutin acids in the recognition of higher plant contribution to recent sediments. In: Campos, R. and J. Goni, eds. Advances in Organic Geochemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 273-287.

de Leeuw, J.W., B.R. Simoneit, J.J. Boon, W.I.C. Rijpstra, F. de Lange, J.C.W. Leeden, V.A. Correia, A.L. Burlingame, and P.A. Schenck[1]. Phytol derived compounds in the geosphere. In: Campos, R. and J. Goni, eds. Advances in Organic Geochemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 61-79.

Francis, S., L. Margulis, W. Caldwell, and E.S. Barghoorn*. Comparison of laboratory silicified blue-green algae with Precambrian microorganisms. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 181-183.

Games, L.M. and J.M. Hayes*. Carbon isotopic study of the fate of landfill leachate in groundwater. Journal of the Water Pollution Control Federation 49(4): 668-677. April 1977.

Golubic, S. and E.S. Barghoorn*. Interpretation of microbial fossils with special reference to the Precambrian. In: Flügel, E., ed. Fossil Algae: Recent Results and Developments. New York, Springer-Verlag, 1977. p. 1-14.

Goodfellow, R.M., J. Cardosa, G. Eglinton, J.P. Dawson, and G.A. Best[1]. A faecal sterol survey in the Clyde estuary. Marine Pollution Bulletin 8(12): 272-276. December 1977.

Hayes*, J.M., D.J. Des Marais, D.W. Peterson, D.A. Schoeller, and S.P. Taylor. High precision stable isotope ratios and microgram samples. In: Daly, N.R., ed. Advances in Mass Spectrometry, Volume 7. London, Institute of Petroleum, 1977.

---

[1]Calvin, M., Principal Investigator

Hayes*, J.M. and D.A. Schoeller. High precision pulse counting: Limitations and optimal conditions. Analytical Chemistry 49(2): 306-311. February 1977.

Hohn, M.E., M.J. Humberston, and G. Eglinton[1]. Storage and retrieval of mass spectral information. Pure and Applied Chemistry 49(12): 1817-1825. 1977.

Ishiwatari, R., M. Ishiwatari, B.G. Rohrback, and I.R. Kaplan*. Thermal alteration experiments on organic matter from recent marine sediments in relation to petroleum genesis. Geochimica et Cosmochimica Acta 41(6): 815-828. June 1977.

Knoll, A.H. and E.S. Barghoorn*. Archean microfossils showing cell division from the Swaziland System of South Africa. Science 198(4315): 396-398. October 28, 1977.

Masursky, H., A.L. Albee, G. Briggs, M.B. Duke, J.W. Schopf*, L. Soderblom, C.P. Sonett, I. Stewart, J.L. Trombka, and J. Wood. Report of the Terrestrial Bodies Science Working Group. Volume 5: Mars. Pasadena, California, Jet Propulsion Laboratory, 1977. (JPL-Pub-77-51-Vol-5) 54 p.

Nagy*, B. and L.A. Nagy. Organic matter in ancient sediments of the Earth. Correlation of the Precambrian 1: 236-256. 1977.

Nagy*, B., L.A. Nagy, J.E. Zumberge, D.S. Sklarew, and P. Anderson. Indications of a biological and biochemical evolutionary trend during the Archean and Early Proterozoic. Precambrian Research 5(2): 109-120. August 1977.

Peters, K.E., R. Ishiwatari, and I.R. Kaplan*. Color of kerogen as index of organic maturity. American Association of Petroleum Geologists Bulletin 61(4): 504-510. April 1977.

Philp[1], R.P. Recent advances in the study of potential kerogen precursors from recently-deposited algal-mats. American Chemical Society, Division of Fuel Chemistry Preprints 22(3): 177-182. 1977.

Philp, R.P. and M. Calvin*. Kerogenous material in recent algal mats at Laguna Mormona, Baja, California. In: Campos, R. and J. Goni, eds. Advances in Organic Geochemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 735-752.

[1]Calvin, M., Principal Investigator

Philp, R.P. and E. Yang[1]. Alkaline potassium permanganate degradation of insoluble organic residues (kerogen) isolated from recently-deposited algal mats. Energy Sources 3(2): 149-161. 1977.

Rambler, M., L. Margulis*, and E.S. Barghoorn*. Natural mechanisms of protection of a blue-green alga against ultraviolet light. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 133-141.

Ripley*, E.M. and H. Ohmoto. Mineralogic, sulfur isotope, and fluid inclusion studies of the stratabound copper deposits at the Raul mine, Peru. Economic Geology 72(6): 1017-1041. September-October 1977.

Schopf*, J.W. Biostratigraphic usefulness of stromatolitic Precambrian microbiotas: A preliminary analysis. Precambrian Research 5(2): 143-173. August 1977.

Schopf*, J.W. Earliest evidence of fossil eucaryotes. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 107-109.

Schopf*, J.W. Evidences of Archean life. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 101-105.

Schopf*, J.W., T.A. Dolnik, I.N. Krylov, C.V. Mendelson, B.B. Nazarov, A.V. Nyberg, Yu.K. Sovietov, and M.S. Yakshin. Six new stromatolitic microbiotas from the Proterozoic of the Soviet Union. Precambrian Research 4(3): 269-284. April 1977.

Simoneit[1], B.R.T. The Black Sea, a sink for terrigenous lipids. Deep-Sea Research 24(9): 813-830. 1977.

Simoneit[1], B.R.T. Diterpenoid compounds and other lipids in deep-sea sediments and their geochemical significance. Geochimica et Cosmochimica Acta 41(4): 463-476. April 1977.

Simoneit[1], B.R.T. Organic matter in eolian dusts over the Atlantic Ocean. Marine Chemistry 5(4-6): 443-464. 1977.

Simoneit[1], B.R.T., R. Chester, and G. Eglinton. Biogenic lipids in particulates from the lower atmosphere over the eastern Atlantic. Nature 267(5613): 682-685. June 23, 1977.

---

[1]Calvin, M., Principal Investigator

Simoneit, B.R.T. and G. Eglinton[1]. Organic matter of eolian dust and its input to marine sediments. In: Campos, R. and J. Goni, eds. Advances in Organic Chemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 415-430.

Wardroper, A.M.K., P.W. Brooks, M.J. Humberston, and J.R. Maxwell[1]. Analysis of steranes and triterpanes in geolipid extracts by automatic classification of mass spectra. Geochimica et Cosmochimica Acta 41(4): 499-510. April 1977.

Watts, C.D. and J.R. Maxwell[1]. Carotenoid diagenesis in a marine sediment. Geochimica et Cosmochimica Acta 41(4): 493-497. April 1977.

Watts, C.D., J.R. Maxwell, and H. Kjosen[1]. The potential of carotenoids as environmental indicators. In: Campos, R. and J. Goni, eds. Advances in Organic Geochemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 391-413.

Watts, C.D., B.R.T. Simoneit, J.R. Maxwell, and J.P. Ragot[1]. The quincyte pigments. A novel series of fossil "dyes" from an Eocene sediment. In: Campos, R. and J. Goni, eds. Advances in Organic Geochemistry, 1975. Madrid, Spain, Enadimsa, 1977. p. 223-235.

Williams, K.M. and G.G. Smith*. A critical evaluation of the application of amino acid racemization to geochronology and geothermometry. Origins of Life 8(2): 91-144. 1977.

[1]Calvin, M., Principal Investigator

Life Detection

Balkwill, D.L., T.E. Rucinsky, and L.E. Casida*, Jr. Release of microorganisms from soil with respect to transmission electron microscopy viewing and plate counts. Antonie van Leeuwenhoek 43(1): 73-87. 1977.

Bok, S.H. and L.E. Casida*, Jr. New microbial growth factor. Applied and Environmental Microbiology 33(5): 1085-1091. May 1977.

Casida*, L.E., Jr. Microbial metabolic activity in soil as measured by dehydrogenase determinations. Applied and Environmental Microbiology 34(6): 630-636. December 1977.

Casida*, L.E., Jr. Small cells in pure cultures of *Agromyces ramosus* and in natural soil. Canadian Journal of Microbiology 23(2): 214-216. February 1977.

Biological Adaptation

Bogomolni[1], R.A. Light energy conservation processes in *Halobacterium halobium* cells. Federation Proceedings 36(6): 1833-1939. May 1977.

Charlang, G. and N.P. Williams[2]. Germination-defective mutant of *Neurospora crassa* that responds to siderophores. Journal of Bacteriology 132(3): 1042-1044. December 1977.

Cooper, G. and L. Margulis*. Delay in migration of symbiotic algae in *Hydra viridis* by inhibitors of microtubule protein polymerization. Cytobios 73(19): 7-19. 1977.

Horowitz, N.H., G.L. Hobby, and J.S. Hubbard*. Viking on Mars: The carbon assimilation experiments. Journal of Geophysical Research 82(28): 4659-4662. 1977.

Hwang, S.-B., J.I. Korenbrot, and W. Stoeckenius*. Structural and spectroscopic characteristics of bacteriorhodopsin in air-water interface films. Journal of Membrane Biology 36(2/3): 115-135. 1977.

Hwang, S.-B., J.I. Korenbrot, and W. Stoeckenius*. Transient photovoltages generated by charge displacements in intermediates of the bacteriorhodopsin photoreaction cycle. In: Packer, L., G.C. Papageorgiou, and A. Trebst, eds. Bioenergetics of Membranes. Proceedings of the International Symposium, Island of Spetsai, Greece, July 10-15, 1977. Amsterdam, Netherlands, Elsevier/North-Holland, 1977. p. 137-147.

Hwang, S.-B. and W. Stoeckenius*. Purple membrane vesicles: Morphology and proton translocation. Journal of Membrane Biology 33(3/4): 325-350. 1977.

Leadbetter*, E.R. and R.A. Slepecky. The diversity of spore-forming bacteria: Some ecological implications. In: Barker, A.N., J. Wolf, D.J. Ellar, G.J. Dring, and G.W. Gould, eds. Spore Research, 1976, Volume 2. New York, Academic Press, 1977. p. 869-877.

Lozier, R.H. and W. Niederberger[1]. The photochemical cycle of bacteriorhodopsin. Federation Proceedings 36(6): 1805-1809. May 1977.

Margulis*, L. Life on the early Earth. Engineering and Science 40(4): 13-19. May-June 1977.

---

[1]Stoeckenius, W., Principal Investigator

[2]Horowitz, N.H., Principal Investigator

Margulis*, L., H.O. Halvorson, J. Lewis, and A.G.W. Cameron. Limitations to growth of microorganisms on Uranus, Neptune, and Titan. Icarus 30(4): 793-808. April 1977.

Margulis*, L., H.O. Halvorson, J. Lewis, and A.G.W. Cameron. Some general principles of planetary quarantine leading to an assessment of the limitations to growth of microorganisms on Uranus and Neptune. In: Holmquist, R., ed. Life Sciences and Space Research, Volume XV. Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8-19, 1976. New York, Pergamon Press, 1977. p. 101-106.

Margulis*, L. and J.E. Lovelock. Planet Earth is our only hope. Geographical Magazine 49(8): 473-478. May 1977.

Margulis*, L. and J.E. Lovelock. The view from Mars and Venus. Sciences 17(2): 10-13. March/April 1977.

Rambler, M., L. Margulis*, and E.S. Barghoorn. Natural mechanisms of protection of a blue-green alga against ultraviolet light. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 133-141.

Stoeckenius*, W., R.H. Lozier, and W. Niederberger. Photoreactions of bacteriorhodopsin. Biophysics of Structure and Mechanism 3(1): 65-68. 1977.

Tindall, D.R., J.H. Yopp*, W.E. Schmid, and D.M. Miller. Protein and amino acid composition of the obligate halophile *Aphanothece halophytica* (Cyanophyta). Journal of Phycology 13(2): 127-133. June 1977.

Walters, C.C., L. Margulis*, and E.S. Barghoorn. On the experimental silicification of microorganisms. I. Microbial growth on organosilicon compounds. Precambrian Research 5(3): 241-248. October 1977.

Wedler*, F.C., B.A. Willis, and R. Srubas. Interaction of extrinsic fluorescent probes with *E. coli* glutamine synthetase. Experientia 33(8): 1016-1018. August 15, 1977.

Bioinstrumentation

No publications.

Planetary Environments

DeVincenzi*, D.L. Effect of sterilization on the scientific value of a returned Mars soil sample. In: Holmquist, R., ed. Life Sciences and Space Research, Volume XV. Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of of COSPAR, Philadelphia, Pennsylvania, June 8-19, 1976. New York, Pergamon Press, 1977. p. 21-26.

Hoffman, J.H., G.M. Keating, H. Niemann, V. Oyama*, J. Pollack, A. Seiff, A.I. Stewart, and U. von Zahn. Composition and structure of the atmosphere of Venus. Space Science Reviews 20(3): 307-327. May 1977.

Klein*, H.P. The Viking biological investigation: General aspects. Journal of Geophysical Research 82(28): 4677-4680. September 30, 1977.

Klein*, H.P. Where are we in the search for life on Mars? Journal of the Astronomical Society of the Pacific 6(2): 2-6. March-April 1977.

Oyama*, V.I. and B.J. Berdahl. The Viking gas exchange experiment: Results from Chryse and Utopia surface samples. Journal of Geophysical Research 82(28): 4669-4676. September 30, 1977.

Oyama*, V.I., B.J. Berdahl, and G.C. Carle. Preliminary findings of the Viking gas exchange experiment and a model for Martian surface chemistry. Nature 265(5590): 110-114. January 13, 1977.

Origin of Life

Andersen, M. and S. Nir[1]. Van der waals parameters, refractive indices and dispersion equations of spectrin, actin, and other mammalian proteins. Polymer 18(9): 867-870. 1977.

Armstrong, D.W. and J.H. Fendler[2]. Differential partitioning of tRNAs between micellar and aqueous phases: A convenient gel filtartion method for separation of tRNAs. Biochimica et Biophysica Acta 478(1): 75-80. September 6, 1977.

Armstrong, D.W., F. Nome, J.H. Fendler, and J. Nagyvary*. Novel prebiotic systems: Nucleotide oligomerization in surfactant entrapped water pools. Journal of Molecular Evolution 9(3): 213-223. 1977.

Armstrong, D.W., R. Seguin, and J.H. Fendler[2]. Partitioning of amino acids and nucleotides between water and micellar hexadecyltrimethyl-ammonium halides. The prebiotic significance of cationic surfaces. Journal of Molecular Evolution 10(3): 241-250. 1977.

Averner, M.M. and R.D. MacElroy*. The Biological Effects of Increased Global UV-B Irradiation: A Computer Simulation Study. NASA-TM-78425. 1977.

Averner, M.M. and R.D. MacElroy*. Speculations on the Consequences to Biology of Space Shuttle-Associated Increases in Global UV-B Radiation. NASA-TM-73200. 1977.

Balch, W.E., L.J. Magrum, G.E. Fox, R.S. Wolfe, and C. Woese*. An ancient divergence among the bacteria. Journal of Molecular Evolution 9(4): 305-311. 1977.

Belliveau, J.W. and J.K. Lanyi*. Analogies between respiration and a light-driven proton pump as sources of energy for active glutamate transport in *Halobacterium halobium*. Archives of Biochemistry and Biophysics 178(1): 308-314. January 15, 1977.

Brooke, S. and S.W. Fox*. Compartmentalization in proteinoid microspheres. BioSystems 9(1): 1-22. 1977.

Coeckelenbergh, Y., R. Rein, and R.D. MacElroy*. Ames interactive molecular model building system: A 3-D computer modelling system applied to the study of the origin of life. BioSystems 9(2,3): 121-129. September 1977.

---

[1]Rein, R., Principal Investigator
[2]Nagyvary, J., Principal Investigator

Dayhoff*, M.O., L.T. Hunt, W.C. Barker, R.M. Schwartz, and B.C. Orcutt. Estimation of the structure of the proteins of all living organisms. In: Dreyfus, B., ed. Proceedings of the Fifth Biennial International CODATA Conference. New York, Pergamon Press, 1977. p. 349-353.

Fox, G.E., L.J. Magrum, W.E. Balch, R.S. Wolfe, and C.R. Woese*. Classification of methanogenic bacteria by 16S ribosomal RNA characterization. Proceedings of the National Academy of Sciences of the U.S.A. 74(10): 4537-4541. October 1977.

Fox, G.E., K.R. Pechman, and C.R. Woese*. Comparative cataloging of 16S ribosomal ribonucleic acid: Molecular approach to procaryotic systematics. International Journal of Systematic Bacteriology 27(1): 44-57. January 1977.

Fox*, S.W. Bioorganic chemistry and the emergence of the first cell. In: van Tamelen, E.E., ed. Bioorganic Chemistry. Volume III: Macro- and Multimolecular Systems. New York, Academic Press, 1977. p. 21-32.

Fox*, S.W. Defeatism in scientific research. In: Klemm, W.R., ed. Discovery Processes in Modern Biology. Huntington, New York, Robert E. Krieger, 1977. p. 123-131.

Fox*, S.W. Lars Onsager (1903-1976). BioSystems 8(4): 161. April 1977.

Fox*, S.W. Organic microstructures and terrestrial protocells. Naturwissenschaften 64(7): 380. July 1977.

Fox*, S.W. and K. Dose. Molecular Evolution and the Origin of Life. Revised edition. New York, Marcel Dekker, 1977. 370 p.

Gabel, N.W. and R.D. MacElroy*. Potential Ecological Effects of Microwave Irradiation. NASA-TM-78429. 1977.

Garduno, R., R. Rein*, J.T. Egan, Y. Coeckelenbergh, and R.D. MacElroy*. Purine-purine base pairs and the origin of transversion type mutations. International Journal of Quantum Chemistry: Quantum Biology Symposium 4: 197-204. 1977.

Hoskins, B.B., J.T. O'Connor, T.A. Shannon, R. Widdus, and J.F. Danielli*. Application of genetic and cellular manipulations to agricultural and industrial problems. BioScience 27(3): 188-191. March 1977.

Jukes*, T.H. Evolution and back-contamination. In: Holmquist, R., ed. Life Sciences and Space Research, Volume XV. Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8-19, 1976. New York, Pergamon Press, 1977. p. 9-14.

Jukes*, T.H. How many anticodons? Science 198(4314): 319-320. October 21, 1977.

Jukes*, T.H. Nearest-neighbor doublets in protein-coding regions of MS2 RNA. Journal of Molecular Evolution 9(3): 299-303. 1977.

Jukes*, T.H. The amino acid code. In: Florkin, M., A. Neuberger, and L.L.M. Van Deenan, eds. Comprehensive Biochemistry. Volume 24: Biological Information Transfer. Amsterdam, Elsevier/North-Holland, 1977. p. 235-293.

Lacey*, J.C., Jr. and A.C. Weber. Genetic coding and protein synthesis: Concerted evolution. Precambrian Research 5(1): 1-22. July 1977.

Lanyi*, J.K. Transport in *Halobacterium halobium*: Light-induced cation-gradients, amino acid transport kinetics, and properties of transport carriers. Journal of Supramolecular Structure 6(2): 169-177. 1977.

MacDonald, R.E., R.V. Greene, and J.K. Lanyi*. Light-activated amino acid transport system in *Halobacterium halobium* envelope vesicles: Role of chemical and electrical gradients. Biochemistry 16(4): 3227-3235. 1977.

MacDonald, R.E. and J.K. Lanyi*. Light-activated amino acid transport in *Halobacterium halobium* envelope vesicles. Federation Proceedings 36(6): 1828-1832. May 1977.

MacElroy*, R.D., Y. Coeckelenbergh, and R. Rein*. Macromolecular simulations as an approach to the study of the origins of self-replicating systems. BioSystems 9(2,3): 111-119. September 1977.

MacElroy*, R.D., Y. Coeckelenbergh, and R. Rein. Molecular Modeling Approaches to the Study of the Origin of Life. NASA-TM-73269. 1977.

Nagyvary*, J. and E.L. Bradbury. Hypocholesterolemic effect of Al^{3+} complexes. Biochemical and Biophysical Research Communications 77(2): 592-598. July 25, 1977.

Nakashima, T., J.R. Jungck, S.W. Fox*, E. Lederer, and B.C. Das. A test for randomness in peptides isolated from a thermal polyamino acid. International Journal of Quantum Chemistry: Quantum Biology Symposium 4: 65-72. 1977.

Nir, S., R. Garduno, R. Rein*, and R.D. MacElroy*. Simulation and display of macromolecular complexes. Polymer 18(5): 431-434. May 1977.

Nir, S., R. Garduno, J.T. Egan, Y. Coeckelenbergh, R.D. MacElroy*, and R. Rein*. Display, manipulation, and simulation of macromolecules. International Journal of Quantum Chemistry: Quantum Biology Symposium 4: 135-141. 1977.

Rein*, R. Studies of biomolecular interactions: Principles of nucleic acid structure and function from the point of view of constituent interactions. In: Pullman, B., ed. Perspectives in Quantum Chemistry. New York, John Wiley & Sons, 1977. p. 307-362.

Rein*, R., R. Garduno, J.T. Egan, S. Columbano, Y. Coeckelenbergh, and R.D. MacElroy*. Elements of a DNA-polypeptide recognition code: Electrostatic potential around the double helix, and a stereospecific model for purine recognition. BioSystems 9(2,3): 131-137. 1977.

Rich*, A. The molecular structure of transfer RNA and its interaction with synthetases. In: Vogel, H.J., ed. Nucleic Acid-Protein Recognition. New York, Academic Press, 1977. p. 281-291.

Rich*, A. An overview of protein-nucleic acid interactions. In: Vogel, H.J., ed. Nucleic Acid-Protein Recognition. New York, Academic Press, 1977. p. 3-11.

Rich*, A. Three-dimensional structure and biological function of transfer RNA. Accounts of Chemical Research 10(11): 388-396. November 1977.

Rich*, A. and P.R. Schimmel. Introduction to transfer RNA. Accounts of Chemical Research 10(11): 385-387. 1977.

Rich*, A. and P.R. Schimmel. Structural organization of complexes of transfer RNAs with aminoacyl transfer RNA synthetases. Nucleic Acids Research 4(5): 1649-1665. 1977.

Rich*, A., N.C. Seeman, and J.M. Rosenberg. Protein recognition of base pairs in a double helix. In: Vogel, H.J., ed. Nucleic Acid-Protein Recognition. New York, Academic Press, 1977. p. 361-374.

Singleton, R., Jr., C.R. Middaugh, and R.D. MacElroy*. Comparison of proteins from thermophilic and nonthermophilic sources in terms of structural parameters inferred from amino acid composition. International Journal of Peptide and Protein Research 10(1): 39-50. 1977.

Souza*, K.A. and P.H. Deal. Characterization of a novel extremely alkalophilic bacterium. Journal of General Microbiology 101(Pt. 1): 103-109. July 1977.

Wang, A.H.-J., G.J. Quigley, and A. Rich*. Crystallographic studies of a mitogenic lectin from pea seeds. Biochemical and Biophysical Research Communications 76(4): 1261-1266. 1977.

Whitaker, N.S. and H.P. Klein*. Low oxygen levels and the palmitoyl CoA desaturase of yeast: Relation to primitive biological evolution. In: Ponnamperuma, C., ed. Chemical Evolution of the Early Precambrian. New York, Academic Press, 1977. p. 211-214.

Woese*, C.R. A comment on methanogenic bacteria and the primitive ecology. Journal of Molecular Evolution 9(4): 369-371. 1977.

Woese*, C.R. Endosymbionts and mitochondrial origins. Journal of Molecular Evolution 10(2): 93-96. 1977.

Woese*, C.R. and G.E. Fox. The phylogenetic structure of the prokaryotic domain: The primary kingdoms. Proceedings of the National Academy of Sciences of the U.S.A. 74(11): 5088-5090. November 1977.

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